Fishery Data Series No. 06-10

Production of Coho Salmon from Chuck Creek in Southeast Alaska, 2003–2004

by

Steven J. McCurdy

March 2006

Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

Symbols and Abbreviations

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Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Department of Fish and Game	ADF&G
Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Measures (fisheries)

fork length	FL
mideye-to-fork	MEF
mideye-to-tail-fork	METF
standard length	SL
total length	TL

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

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ABSTRACT

The purpose of this study was to estimate smolt production, marine survival, exploitation rates, and escapements of coho salmon *Oncorhynchus kisutch* from the Chuck Creek watershed in Southeast Alaska. Emigrating coho smolt were captured during the spring of 2003, tagged with a coded wire tag (CWT), and marked with an adipose fin clip. Commercial and sport fisheries were sampled for coho salmon marked with CWTs in 2004. The escapement was counted through a weir at Chuck Creek in 2004 and coho salmon were examined for marks.

In 2003, a smolt weir was installed in Chuck Creek to capture emigrating coho smolt. A total of 23,005 coho smolt > 75 mm FL were tagged and released alive. In 2004, 203 random recoveries of coho salmon bearing CWTs of Chuck Creek origin were recovered in sampled marine fisheries, and the estimated marine harvest was 980 fish (SE = 94). A total of 481 jack (in 2003) and 606 adult (in 2004) coho salmon returned to Chuck Creek from the 2003 smolt emigration. An estimated 29,302 (SE = 456) coho salmon smolt emigrated from Chuck Creek in 2003. Estimated marine survival to adult of the 2003 smolt emigration was 5.4% (SE = 0.3%) and the exploitation rate in marine fisheries was estimated at 61.8% (SE = 2.2%).

Key words: coho salmon, *Oncorhynchus kisutch*, Chuck Creek, Warm Chuck, Heceta Island, Southeast Alaska, mark-recapture, coded wire tag, recreational fishery, troll fishery, seine fishery, smolt production, marine survival, exploitation rate, escapement, weir, jack.

INTRODUCTION

Exploitation of wild coho salmon (*Oncorhynchus kisutch*) in Southeast Alaska is important to numerous commercial, sport and subsistence users (Shaul et al. 2003; Halupka et al. 2000). Wild coho salmon stocks are widely distributed in Southeast Alaska and are believed to be present in over 2,500 streams (Shaul et al. 2003). The Alaska Department of Fish and Game (ADF&G) maintains a stock assessment program in Southeast Alaska to better understand and manage coho salmon stocks in the region. ADF&G's stock assessment program includes monitoring a number of key coho salmon stocks in Southeast Alaska where juvenile coho are marked with coded wire tags (CWTs). Systematically sampling escapements and harvest in fisheries for coho salmon with CWTs allows for estimates of total smolt production as well as marine survival, exploitation rates and contributions to various fisheries from the monitored stocks. Data collected from the stock assessment program helps managers assess the effectiveness of regulations to ensure sustained yield of these and neighboring stocks of coho salmon.

Chuck Creek was selected to be part of the coho salmon stock assessment program in 2001 to fill the geographical gap in coverage in Southeast Alaska for the southern outside coast. The Chuck Creek watershed is located on Heceta Island (Figure 1), about 35 km northwest of Craig, and is believed to produce about 3,000 adult coho salmon annually (Shaul et al. 1991). Prior to this study, an adult salmon weir was operated successfully on Chuck Creek in 1950 (Edgington et al. 1981) as well as 1982, 1983 and 1985 (Shaul et al. 1991). Also, pre-smolt juvenile coho salmon from Chuck Creek were marked with CWTs in the early 1980s to estimate survival, fishery contributions and exploitation rates (Shaul et al. 1991). Recoveries of coho salmon with CWTs in commercial fisheries in the 1980s indicate that the Chuck Creek stock has an ocean distribution and exploitation pattern similar to that of coho salmon from the Klakas River on nearby Prince of Wales (POW) Island (Shaul et al. 1991).

The Chuck Creek watershed drains an area of approximately 750 hectares (1,853 acres), and contains Chuck Lake, which has a surface area of approximately 63 hectares (155 acres). Chuck Lake drains to the south into Warm Chuck Inlet by way of the 1.5-km long outlet stream, Chuck Creek. Four separate tributary streams to the lake contain spawning and rearing habitat for anadromous fish. The watershed is generally low gradient and the highest point of elevation in the drainage is 169 meters (553 feet) above sea level. The topography of the watershed is predominately Karst (formed on carbonated bedrock, mostly limestone) and there are numerous springs and ground water sources present, indicating a well-

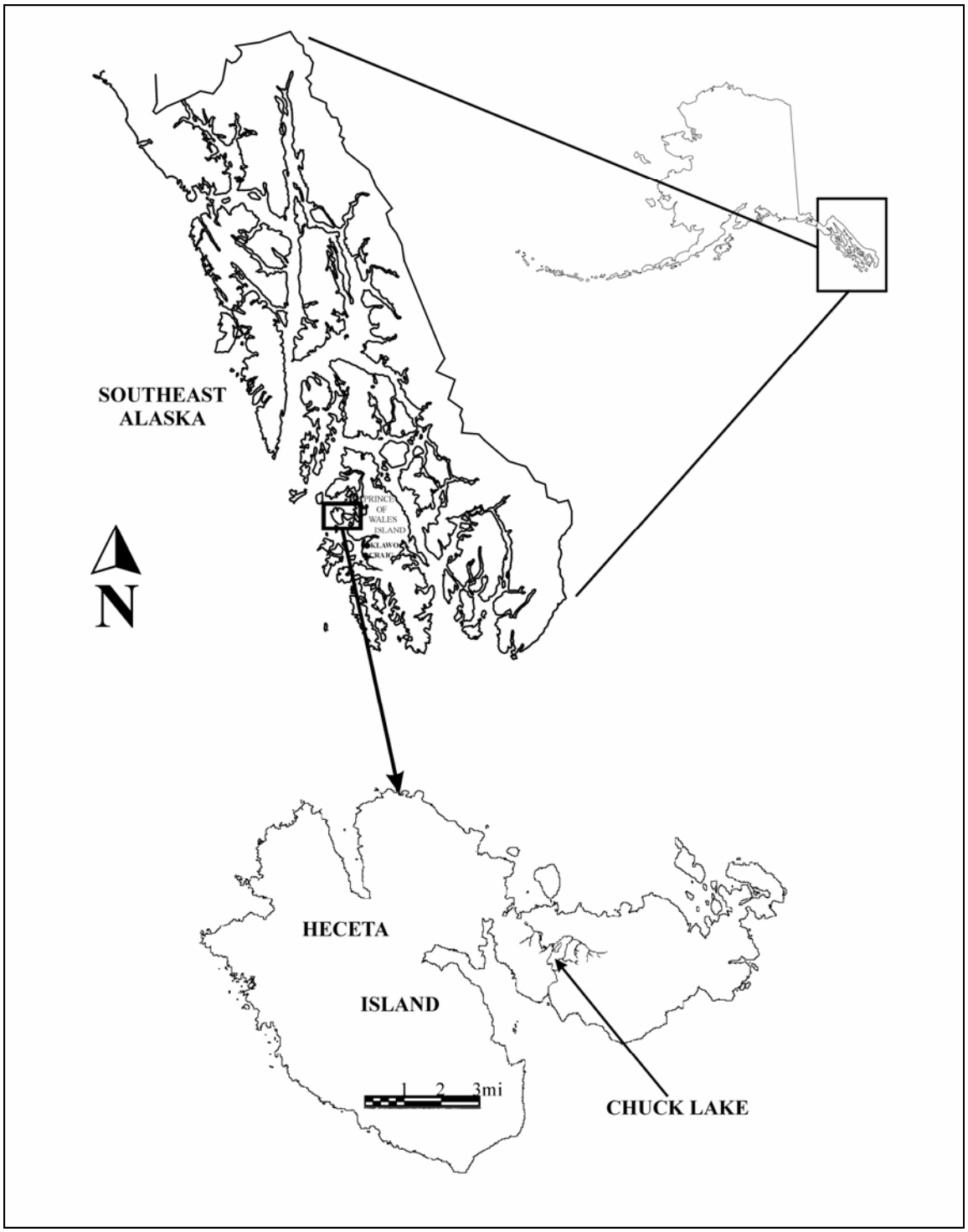

Figure 1.–Location of Heceta Island and the Chuck Creek watershed**.**

developed subsurface drainage pattern typically associated with Karst geology (Baichtal and Swanston 1996). The majority of the watershed was logged in the 1970s and 1980s, at which time extensive timber harvest occurred in riparian areas and along the lakeshore. A vast network of logging roads is present throughout the watershed. The watershed contains numerous beaver dams and ponds, and vegetation in the riparian area is significantly influenced by beaver (*Castor canadensis*) activity. In addition to coho salmon, Chuck Creek contains sockeye salmon (*O. nerka*), pink salmon (*O. gorbuscha*), and chum salmon (*O. keta*), as well as Dolly Varden char (*Salvelinus malma*), steelhead (*O. mykiss*) and cutthroat trout (*O. clarki*), as well as threespine stickleback (*Gasterosteus aculeatus*) and sculpin (*Cottus* spp.).

Objectives of this study were to:

1. Count the escapement of coho salmon returning to Chuck Creek in 2004;
2. Estimate the age and sex composition, and mean length at age of the escapement of coho salmon to Chuck Creek in 2004;
3. Estimate the marine harvest of coho salmon from Chuck Creek in 2004 via recovery of CWTs;
4. Estimate the number of coho salmon smolt emigrating from Chuck Creek in 2003; and,
5. Estimate the age composition, and mean length and weight of coho salmon smolt emigrating from Chuck Creek in 2003.

In addition, all other adult and juvenile salmonids of other species (other than young of the year fry) were counted through the adult and smolt weirs.

An added benefit of this study is the monitoring of coho salmon production over time with the possibility of identifying factors that affect coho salmon production. Factors that could influence smolt production include escapement magnitudes, abiotic factors, and anthropomorphic changes to the watershed (such as large scale timber harvesting and road building).

METHODS

Coho salmon smolt emigrating from Chuck Creek were marked with CWTs in the spring of 2003. Adult coho salmon were sampled in the harvest of commercial and sport fisheries in 2004 for the presence of CWTs. The escapement of mature coho salmon was monitored through a weir on Chuck Creek in 2004 and fish were inspected for missing adipose fins and CWTs to determine the marked fraction (θ). The term "adult" is used to describe coho salmon that mature and return to spawn the year following their emigration from fresh water (noted as age x.1 or 1-ocean fish), and the term "jack" is used to describe male coho salmon that mature and return to spawn in the same year as their emigration from fresh water (noted as age x.0 or 0-ocean fish). The term "mature" refers to all coho salmon (both jack and adult) that are sexually mature and returning to spawn.

SMOLT CAPTURE AND CODED WIRE TAGGING

Coho salmon smolt were captured in the spring 2003 as they emigrated from the Chuck Creek watershed using a weir and "trough" trap similar to that described by Elliott (1992). The weir and trough trap was constructed on Chuck Creek at the site of a blown-out beaver dam located approximately 500 meters upstream from salt water. The opening in the beaver dam was repaired using 2"x 8" rough-cut lumber planks to raise the water level upstream of the dam approximately 1 meter. A "V" shaped perforated plastic fence upstream of the dam extended from both banks and funneled emigrating smolt to the entrance of the trough located on the top of the rebuilt dam. The fence was constructed using two 50' rolls of 5' wide, 3/16" mesh Vexar®[1], held in place with iron pipe pounded into the substrate. The bottom 12" of the fence was folded facing upstream on the bottom of the stream and weighted down with rocks and sand bags to seal any openings large enough for fish passage. The top of the fence extended above the water surface. The trough was prefabricated out of aluminum

[1] Product names used in this report are included for scientific completeness, but do not constitute a product endorsement.

and was approximately 8' long and 12" wide. Four-inch diameter flexible sewer hose was attached to the downstream end of the trough to funnel fish into a live box located just downstream of the beaver dam. The live box was prefabricated aluminum and had perforated aluminum on one side to allow for water flow. The trap was fished continuously from April 15 until May 24. Coded wire tagging usually occurred daily, but during periods when few fish were captured, fish would be held overnight (up to two days) until a sufficient number were available to make tagging cost-effective. Captured fish were removed from the live box several times a day and sorted by species. The number of coho salmon smolt captured was estimated when the trap was checked, and the actual number captured was derived from the number of smolt tagged. When the trough trap was checked, coho salmon smolt had to be sorted from sockeye salmon smolt and other species and the logistics of sorting through large quantities of smolt in a short period of time made precise counts unpractical until the fish could be identified and counted at the time of tagging. All non-coho salmon species other than young of the year (YOY) salmonid fry, which could freely pass through the trap fence and perforated live box wall, were counted and released at the trap site. All captured coho salmon ≥ 75 mm fork length (FL) that appeared healthy were counted, anesthetized with a solution of tricain-methane-sulfonate (MS 222), tagged with a 1.1 mm CWT injected into their snout, and marked with an adipose fin clip. Mark IV tagging machines (Northwest Marine Technology, INC.) were used for tagging. Tag placement was checked at the beginning of tagging operations and periodically throughout the season using methods suggested in Koerner (1977). Short-term (16 hr) CWT loss and mortality due to the handling and tagging procedures was evaluated by holding all fish overnight, after which time they were inspected for mortalities and the presence of a CWT using a metal (tag) detector; tagged fish were then released downstream of the trap. Tag retention procedures required that a random sample of at least 100 fish have a retention rate of 98% or greater. If the sample had less than 98% retention of their CWTs, then the entire batch of fish was checked for the presence of CWTs and retagged if found missing a tag. The number of fish tagged, the number of overnight mortalities following tagging, and the number of fish that had shed their tags was recorded on *ADF&G Tagging Summary and Release Information Forms*, which were submitted (along with a sample of the coded wire used) to ADF&G, Division of Commercial Fisheries Mark, Tag, and Age Laboratory in Juneau at the end of field operations. The tag codes used in 2003 were 04-05-28 and 04-05-29. Water temperatures were recorded daily at approximately 8:00 AM at the weir site.

ESTIMATION OF SMOLT ABUNDANCE

A two-event mark-recapture experiment for a closed population was used to estimate the abundance of coho salmon smolt emigrating from the Chuck Creek watershed in 2003. Event 1 consisted of sampling to mark fish ≥ 75 mm FL with CWTs in 2003. Event 2 included sampling returning mature coho salmon in 2003 (jacks) and 2004 (adults) to determine θ for the watershed.

The abundance of coho salmon smolt emigrating from Chuck Creek in 2003 was estimated using Chapman's modification to the Petersen estimator for a closed population (Seber 1982):

$$\hat{N} = \frac{(n_1 + 1)(n_2 + 1)}{(m_2 + 1)} - 1 \qquad (1)$$

$$\text{var}[\hat{N}] = \frac{(n_1 + 1)(n_2 + 1)(n_1 - m_2)(n_2 - m_2)}{(m_2 + 1)^2 (m_2 + 2)} \qquad (2)$$

where n_1 was the number of smolt marked in 2003 by removing their adipose fin, n_2 was the number of returning coho salmon inspected for marks in 2003 (jacks only) and 2004 (adults only), and m_2 was the subset of n_2 missing their adipose fins from the 2003 tagging on Chuck Creek.

The conditions for an accurate estimate of smolt abundance using this methodology were: (1) all fish had an equal probability of being marked as smolt in event 1, *or* all fish had an equal probability of being inspected for marks in event 2, *or* marked fish mixed completely with unmarked fish in the population between events; (2) both recruitment and death (emigration) do not occur between events; (3*)* marking does not effect catchability (or mortality) of fish; (4) fish did not lose their marks

between events; and (5) all marks were reported on recovery in event 2 (Seber 1982, p. 59). The validity of these assumptions is evaluated in the Discussion section below.

ESTIMATION OF SMOLT AGE, WEIGHT AND LENGTH

A random sample of coho smolt was selected from the fish that were held overnight following each tagging session by gently mixing all the fish in the holding pen with a dip net, taking a random scoop, and sampling all the fish in the scoop. Sampled smolt were measured to the nearest mm FL and weighed to the nearest g. A scale sample was taken for age determination. The sampling rate was stratified by time into two strata (due to the emigration being much larger than expected). In the first stratum, every 30th fish was sampled through May 7 after which the rate was changed to every 60th fish (the 2nd stratum) for the remainder of the emigration. Scale samples were taken from the preferred area as described by Scarnecchia (1979), and mounted between two 25-mm x 75-mm microscope slides. Slides and scale samples were labeled to match corresponding recorded length and weight data. Scale samples were viewed at magnification and ages recorded in European notation. Ages were determined one time by one reader.

The fraction of the emigration belonging to each age group a in each temporal strata h was estimated:

$$\hat{p}_{a,h} = \frac{n_{a,h}}{n_h} \tag{3}$$

$$\text{var}(\hat{p}_{a,h}) = \left[1 - \frac{n_h}{N_h}\right] \frac{\hat{p}_{a,h}\left(1 - \hat{p}_{a,h}\right)}{n_h - 1} \tag{4}$$

where n_h is the number of fish with age determined in strata h, $n_{a,h}$ is the subset of n_h belonging to group a, and N_h is the total number of fish enumerated in stratum h.

The estimated emigration $\hat{N}$ by age is:

$$\hat{N}_a = \sum_h N_h \hat{p}_{a,h} \tag{5}$$

$$\text{var}\left(\hat{N}_a\right) = \sum_h N_h^2 \,\text{var}(\hat{p}_{a,h}) \tag{6}$$

The fraction of the emigration that belong to each age group is:

$$\hat{p}_a = \frac{\hat{N}_a}{N} \tag{7}$$

$$\text{var}\left(\hat{p}_a\right) = N^{-2} \,\text{var}\left(\hat{N}_a\right) \tag{8}$$

where N is the total emigration captured (smolt weir count).

MEAN LENGTH AT AGE

Mean length at age ($\bar{\ell}_a$) for the sampled coho salmon population was estimated using the estimated number of fish at age by time period passing the weir ($\hat{N}_{a,h}$) as weights:

$$\bar{\ell}_{a,h} = \frac{1}{n_{a,h}} \sum_i \ell_{a,h,i} \tag{9}$$

$$\text{var}\left(\bar{\ell}_{a,h}\right) = \left[1 - \frac{n_{a,h}}{\hat{N}_{a,h}}\right] \sum_i \frac{\left(\ell_{a,h,i} - \bar{\ell}_{a,h}\right)^2}{n_{a,h}\left(n_{a,h} - 1\right)} \tag{10}$$

$$\bar{\ell}_a = \frac{1}{\hat{N}_a} \sum_h \hat{N}_{a,h}\, \bar{\ell}_{a,h} \tag{11}$$

$$\text{var}(\bar{\ell}_a) = \sum_h \frac{\left(\bar{\ell}_{a,h}\hat{N}_a - \left(\sum_k \bar{\ell}_{a,k}\hat{N}_{a,k}\right)\right)^2}{\hat{N}_a^4} \text{var}\left(\hat{N}_{a,h}\right) + \sum_h \frac{\hat{N}_{a,h}^2}{\hat{N}_a^2} \text{var}\left(\bar{\ell}_{a,h}\right) \tag{12}$$

where $\ell_{a,h,i}$ is the length of individual fish i and equation (12) is an approximation derived using the delta method (Mood et al. 1974, p. 181). The finite population correction factor (fpc, $0 \le (1 - n_{a,h}/\hat{N}_{a,h}) \le 1$) in equation (10) is omitted if

$\hat{N}_{a,h}$ is relatively imprecise and/or the fpc is small. Referring to equations 10 and 12 above, $\hat{N}_{a,h}$ and its variance are:

$$\hat{N}_{a,h} = N_h \ \hat{p}_{a,h} \qquad (13)$$

$$\mathrm{var}\left(\hat{N}_{a,h}\right) = N_h^2 \ \mathrm{var}\left(\hat{p}_{a,h}\right) \qquad (14)$$

MARINE HARVEST

Estimates of the harvest of coho salmon originating from Chuck Creek and its variance were derived from fish sampled from harvest in commercial and recreational sport fisheries using standard methods (Bernard and Clark 1996). Because several fisheries exploited coho salmon bound for Chuck Creek over several months in 2004, harvest was estimated over several strata, each a combination of time, area, and type of fishery. Statistics from the commercial troll fishery were stratified by fishing period and by fishing quadrant. Statistics from the purse seine fishery were stratified by week and fishing district. Statistics from the sport fishery were stratified by fortnight. Hubartt et al. (1999) present details of sampling sport fisheries. An ADF&G Commercial Fisheries Division manuscript (ADF&G *Unpublished*) describes sampling of commercial fisheries in Southeast Alaska in which samplers stationed at fish processors throughout Southeast Alaska attempt to sample 20% of the commercial coho salmon harvest for missing adipose fins. Databases from the Pacific States Marine Fisheries Commission (PSMFC) are also queried for any reported recoveries of coho salmon containing CWTs from Chuck Creek in Canadian Fisheries.

Estimates of the 2004 harvest r_{ij} of Chuck Creek coho salmon from the 2003 smolt emigration j to one fishery stratum i were calculated:

$$\hat{r}_{ij} = \hat{H}_i \left(\frac{m_{ij}}{\lambda_i n_i} \right) \hat{\theta}_j^{-1} \qquad (15)$$

where H_i is the estimated harvest in stratum i, θ_j is the marked fraction of stock j possessing CWTs (the portion of the *adult* escapement sampled *found to have CWTs*), n_i is the subset of H_i examined for missing adipose fins, m_{ij} is the number of decoded CWTs recovered from stock j in stratum i, and $\lambda_i=(a_i' \ t_i')/(\ a_i \ t_i \ )$ is the decoding rate for CWTs from recovered salmon (a_i is the number of adipose clipped fish in the sample from stratum i, a_i' is the subset of a_i for which heads reach the laboratory, t_i is the subset of a_i' with CWTs detected, and t_i' is the subset of t_i with CWTs decoded). Estimates of harvest were summed across strata and fisheries to obtain an estimate of the total harvest $T = \sum \hat{r}_{ij}$. Because sampling was independent across strata and across fisheries the variance of the total harvest was estimated by summing the variances across strata. See Bernard and Clark (1996) for further details.

ESCAPEMENT ENUMERATION AND ESTIMATES OF AGE, SEX AND LENGTH

An aluminum bipod and picket weir was installed across the lower end of Chuck Creek (approximately 500 meters from salt water) and operated from August 15 until October 14 in 2004. Pickets were 18 mm in diameter with a maximum gap of 31 mm. The bottom and sides of the weir were sealed with sandbags and the weir was monitored continuously. A 2.4 m square trap was built into the weir to capture and hold all migrating salmon. All migrating salmon had to enter the trap to pass upstream.

All migrating mature salmon were identified and counted by species as they passed the weir. All coho salmon were counted by life-history type (adult and jack) and examined for missing adipose fins. Life-history type was assumed to be accurately determined for each fish enumerated at the weir. Fish that were 400 mm in FL or larger were considered adults and those less than 400 mm FL were considered jacks. Any fish between 380 mm and 450 mm had a scale sample taken to verify salt-water age.

Coho salmon were systematically sampled throughout the entire migration for age, sex, and length (ASL). The sampling rate was stratified by time into two strata (due to the escapement being much smaller than expected). In the first stratum every 5th coho salmon (adult or jack) was sampled through September 14 when the rate was changed to every 3rd fish (2nd Stratum) for the remainder of

the immigration. All sampled coho salmon missing an adipose fin were also examined for CWTs using a magnetometer (hand held CWT detector from Northwest Marine Technology, Inc.). Total escapement was the number of coho salmon counted through the weir. These numbers were divided into the number of jacks and the number of adults.

The fraction of the migration from each life-history state that belonged to each freshwater age or sex group *a* in each temporal strata *h* was estimated using equations 3 and 4. The estimated migration $\hat{N}$ by age or sex group from each life-history type was estimated using equations 5 and 6, and the fraction of the migration that belong to each age or sex group from each life-history type was calculated using equations 7 and 8. Mean length at freshwater age ($\bar{\ell}_a$) from each life-history type for the sampled coho salmon population was estimated using equations 9-12.

ESTIMATES OF TOTAL ADULT RUN, EXPLOITATION, AND MARINE SURVIVAL

The total adult run of the coho salmon bound for Chuck Creek in 2004 and its variance was calculated by summing estimates of total harvest (*T*) and the adult escapement (N_e):

$$\hat{N}_R = \hat{T} + N_e \tag{16}$$

$$\text{var}[\hat{N}_R] = \text{var}[\hat{T}] \tag{17}$$

where $\text{var}[N_e]$ is not added into (17) because it is 0. The estimate of the adult exploitation rate was calculated:

$$\hat{E} = \frac{\hat{T}}{\hat{N}_R} \tag{18}$$

$$\text{var}[\hat{E}] \approx \frac{\text{var}[\hat{T}]\, N_e^2}{\hat{N}_R^4} \tag{19}$$

where variance was approximated with the delta method (Seber 1982), recalling that $\text{var}[N_e] = 0$.

Smolt to adult survival rate was estimated as:

$$\hat{S} = \frac{\hat{N}_R}{\hat{N}_s} \tag{20}$$

$$\text{var}[\hat{S}] \approx \hat{S}^2 \left[\frac{\text{var}[\hat{N}_R]}{\hat{N}_R^2} + \frac{\text{var}[\hat{N}_s]}{\hat{N}_s^2} \right] \tag{21}$$

where N_s is the smolt abundance from (1) and variance was approximated with the delta method.

RESULTS

SMOLT TAGGING, SAMPLING AND ABUNDANCE IN 2003

A total of 23,042 coho salmon smolt ≥ 75 mm FL were tagged between April 15 and May 24, 2003 (Table 1). Twenty-three fish died after tagging and an estimated 14 fish shed their tags within 24 hours, leaving a total of 23,019 smolt that were released with adipose clips and 23,005 with valid CWTs in 2003. About an equal number of coho salmon smolt were tagged with the two different tag codes used in 2003; 11,347 fish were released with code 040528 from April 15 until May 7, and 11,658 fish were released with code 040529 from May 7 until May 24. A small number of coho salmon smolt less than 75 mm FL (estimated at < 100) were captured and released untagged during weir operations because they did not meet the minimum size requirement for tagging. Fish captured on the last day of weir operations (May 25, Table 2) were also released untagged.

Emigrating coho salmon smolt were first captured in the trough trap on April 16 and catches increased to over a thousand fish a day by the end of April (Table 2). The timing of the coho salmon smolt emigration was pulsed throughout the migration period with the single largest catch occurring on May 14, when almost 9% of all smolt sampled were captured in a 24-hour period (Figure 2). Catches declined by May 25, however coho salmon smolt were still migrating when the trap was dismantled for the season (Figure 2; Table 2).

A total of 616 captured coho salmon smolt ≥ 75 mm FL were sampled for age, length and weight (Table 3). Age-1 coho smolt constituted 76.0% (SE = 1.6%) of the sample and averaged 93.8 mm

Table 1.–Summary of coho salmon smolt tagged with coded wire tags, held overnight, and released following sampling for 24-hour tag retention at Chuck Creek in 2003.

					# Released with	
Date	**Tag code**	**Total tagged**	**Overnight mortality**	**Live tagged**	**valid tags**	**shed tags**
4/18	04-05-28	3	0	3	3	0
4/20	04-05-28	23	0	23	23	0
4/22	04-05-28	69	1	68	68	0
4/24	04-05-28	71	1	70	70	0
4/25	04-05-28	80	0	80	80	0
4/26	04-05-28	260	0	260	260	0
4/27	04-05-28	1,010	0	1,010	1,010	0
4/28	04-05-28	1,666	1	1,665	1,665	0
4/29	04-05-28	1,475	0	1,475	1,475	0
4/30	04-05-28	1,585	1	1,584	1,584	0
5/1	04-05-28	1,202	1	1,201	1,201	0
5/2	04-05-28	1,385	12	1,373	1,364	9
5/3	04-05-28	682	3	679	674	5
5/4	04-05-28	583	0	583	583	0
5/5	04-05-28	401	0	401	401	0
5/6	04-05-28	405	0	405	405	0
5/7	04-05-28	481	0	481	481	0
Code 04-05-28 subtotal:		**11,381**	**20**	**11,361**	**11,347**	**14**
5/7	04-05-29	566	0	566	566	0
5/8	04-05-29	1,014	0	1,014	1,014	0
5/9	04-05-29	1,209	1	1,208	1,208	0
5/10	04-05-29	915	0	915	915	0
5/11	04-05-29	243	0	243	243	0
5/12	04-05-29	80	0	80	80	0
5/13	04-05-29	666	0	666	666	0
5/14	04-05-29	2,065	0	2,065	2,065	0
5/15	04-05-29	1,229	1	1,228	1,228	0
5/16	04-05-29	440	0	440	440	0
5/17	04-05-29	799	0	799	799	0
5/18	04-05-29	558	0	558	558	0
5/19	04-05-29	685	0	685	685	0
5/20	04-05-29	579	0	579	579	0
5/21	04-05-29	245	0	245	245	0
5/22	04-05-29	155	1	154	154	0
5/23	04-05-29	61	0	61	61	0
5/24	04-05-29	152	0	152	152	0
Code 04-05-29 subtotal:		**11,661**	**3**	**11,658**	**11,658**	**0**
Grand Total		**23,042**	**23**	**23,019**	**23,005**	**14**

FL (SE = 0.4) and 8.0 g (SE = 0.1). Age-2 coho smolt constituted 24.0% (SE = 1.6%) of the sample and averaged 107.9 mm FL (SE= 0.9) and 12.2 g (SE = 0.2, Table 4; Figure 3).

Surviving fish from the 2003 smolt emigration returned to Chuck Creek in both 2003 (as jacks) and 2004 (as adults), and each returning fish was examined for a missing adipose fin to determine the marked fraction (θ). In the 2003 escapement, 374 of 478 jacks examined (θ =0.782) were missing adipose fins (McCurdy 2005). In the 2004 escapement, 475 of 603 adults examined (θ =0.788) were missing their adipose fin. These two marked fractions were not significantly different (χ^2 = 0.005, df = 1, P = 0.94). Pooling both escapement samples (849 of 1,081 examined) yielded an estimate of θ =0.785 for the fraction of the 2003 smolt emigration marked. An estimated 29,302 (SE = 456) coho salmon smolt emigrated from Chuck Creek in 2003 (n_1 = 23,019, n_2 = 1,081, m_2 = 849).

Table 2.–Estimated daily count of all downstream migrating fish captured at Chuck Creek, spring 2003.

Date	Coho smolt	Sockeye smolt	Dolly Varden Adults[a]	Dolly Varden Juveniles[b]	Steelhead Juveniles[c]	Cutthroat Adults[a]	Cutthroat Juveniles[b]	Sculpin
4/15	0	0	0	0	0	0	0	0
4/16	1	0	0	0	0	0	1	27
4/17	1	1	2	0	0	0	1	29
4/18	3	0	2	0	0	0	0	52
4/19	5	0	4	0	1	0	0	67
4/20	32	1	97	0	0	1	1	111
4/21	37	2	84	0	0	0	2	87
4/22	35	4	44	0	0	0	0	119
4/23	32	1	52	0	0	0	0	76
4/24	71	6	63	0	0	0	0	48
4/25	163	21	36	0	1	1	1	61
4/26	742	30	12	0	0	0	2	92
4/27	693	12	26	0	0	0	1	63
4/28	1,500	37	15	1	0	0	0	51
4/29	1,306	63	24	0	1	0	0	38
4/30	1,612	293	24	1	0	0	2	102
5/1	1,203	212	3	0	0	0	0	186
5/2	1,388	458	5	1	0	0	1	114
5/3	685	783	3	1	0	0	0	105
5/4	583	923	5	1	2	0	0	78
5/5	401	1,452	1	3	2	0	1	117
5/6	405	2,011	4	10	0	0	0	82
5/7	1,047	2,220	9	1	0	0	0	52
5/8	1,014	2,575	9	4	0	0	0	77
5/9	1,209	3,921	14	6	1	0	2	44
5/10	915	1301	49	5	1	0	0	40
5/11	243	579	5	3	1	0	0	76
5/12	81	1,230	25	8	0	0	0	75
5/13	666	691	18	9	0	0	0	84
5/14	2,069	1,030	30	3	0	0	3	60
5/15	1,229	2,350	88	49	0	0	1	89
5/16	440	1,038	57	135	0	0	0	64
5/17	799	1,653	243	125	2	0	0	86
5/18	558	1,910	168	80	1	0	0	176
5/19	685	897	34	129	0	0	1	157
5/20	579	235	2	26	0	0	0	95
5/21	245	128	3	50	1	0	0	124
5/22	155	100	0	13	0	0	0	57
5/23	61	92	11	43	0	0	1	79
5/24	152	219	17	83	0	0	0	98
5/25	220	112	53	126	1	0	1	53
Totals	**23,265**	**28,591**	**1,341**	**916**	**15**	**2**	**22**	**3,291**

[a] Fish ≥ 175 mm FL.

[b] Fish < 175 mm FL.

[c] All fish sexually immature. Includes both fish that appear to be smolt and non-smolt.

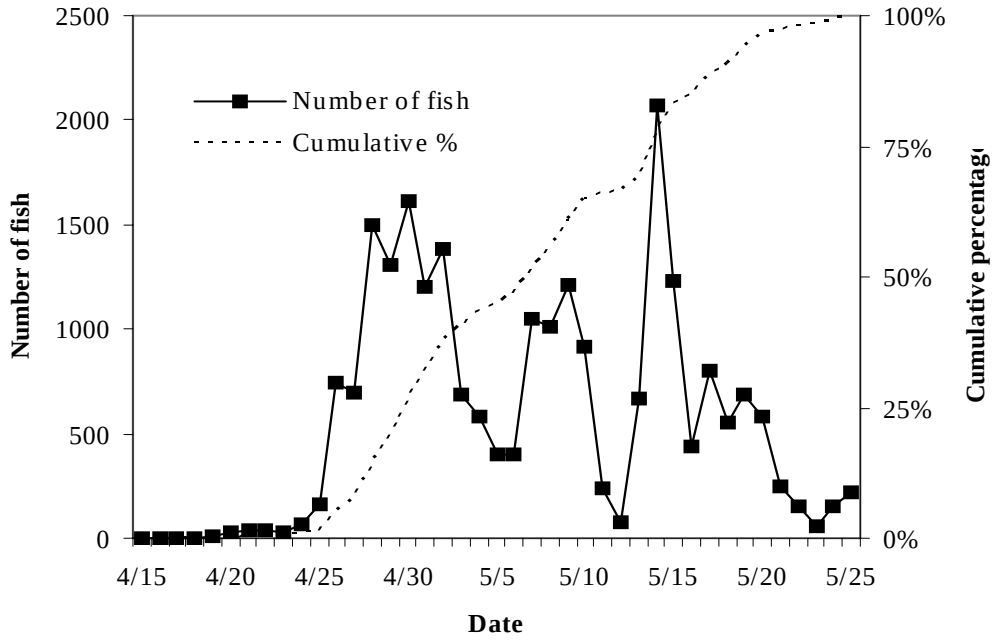

Figure 2.–Estimated daily catch and cumulative percentage of the coho salmon smolt emigration captured at Chuck Creek in 2003.

ESCAPEMENT ENUMERATION, AND ADULT AND JACK SAMPLING IN 2004

The 2004 escapement was comprised of mature coho salmon from two separate cohorts of emigrating smolt. A total of 603 adult (from the 2003 smolt emigration) and 606 jack (from the 2004 smolt emigration) coho salmon were counted past the weir on Chuck Creek between August 15 and October 14, 2004 (Appendix A1). An additional 3 adult coho salmon were counted downstream of the weir when it was dismantled on October 14. In 2003 a total of 481 jack coho salmon from the 2003 smolt emigration were counted in the escapement past the weir (McCurdy 2005). Life-history type (adult, jack) was considered accurately determined on all mature fish in the 2004 escapement as no overlap in FL between jacks and adults was detected by aging a random sample of 304 fish, and no fish were found in the range between 380 and 490 mm FL (Figure 4). In the previous 3 years of monitoring the escapement of coho salmon at Chuck Creek, there has also been no overlap in fork length detected between jacks and adults, as the largest jack has been 395 mm FL and the smallest adult has been 400 mm FL (McCurdy 2005). The temporal pattern of immigration of the

Table 3.–Sample sizes for age, weight, and length determination by temporal strata and age, of coho salmon smolt captured at Chuck Creek in 2003.

Strata (date)	Number of smolt	Number sampled		
		age-1	age-2	total
1 (4/15–5/7)	10,880	230	116	346
2 (5/8–5/24)	12,139	228	42	270
Total	**23,019**	**458**	**158**	**616**

Table 4.–Estimated age composition and mean length and weight at age of emigrating coho salmon smolt captured at Chuck Creek in 2003.

	Age 1	Age 2	Combined
Estimated composition	76%	24%	100%
SE age composition	1.6%	1.6%	
Mean length (mm)	93.8	107.9	97.0
SE Mean length	0.4	0.9	0.4
Mean weight (g)	8	12.2	8.9
SE mean weight	0.1	0.2	0.1

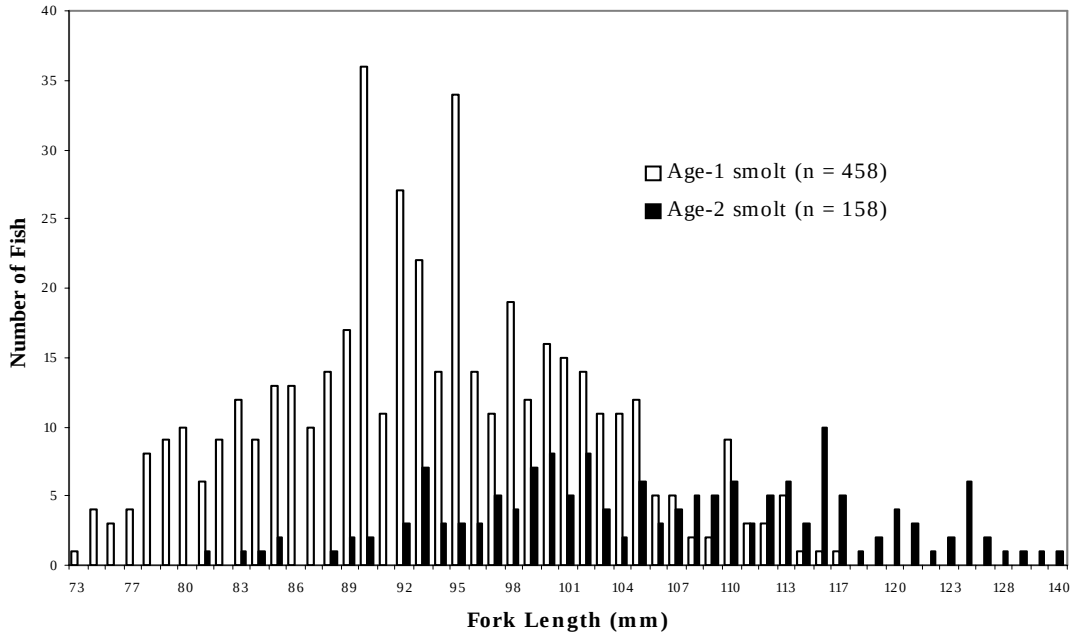

Figure 3.–Length frequency, by age of sampled coho salmon smolt emigrating from Chuck Creek in 2003.

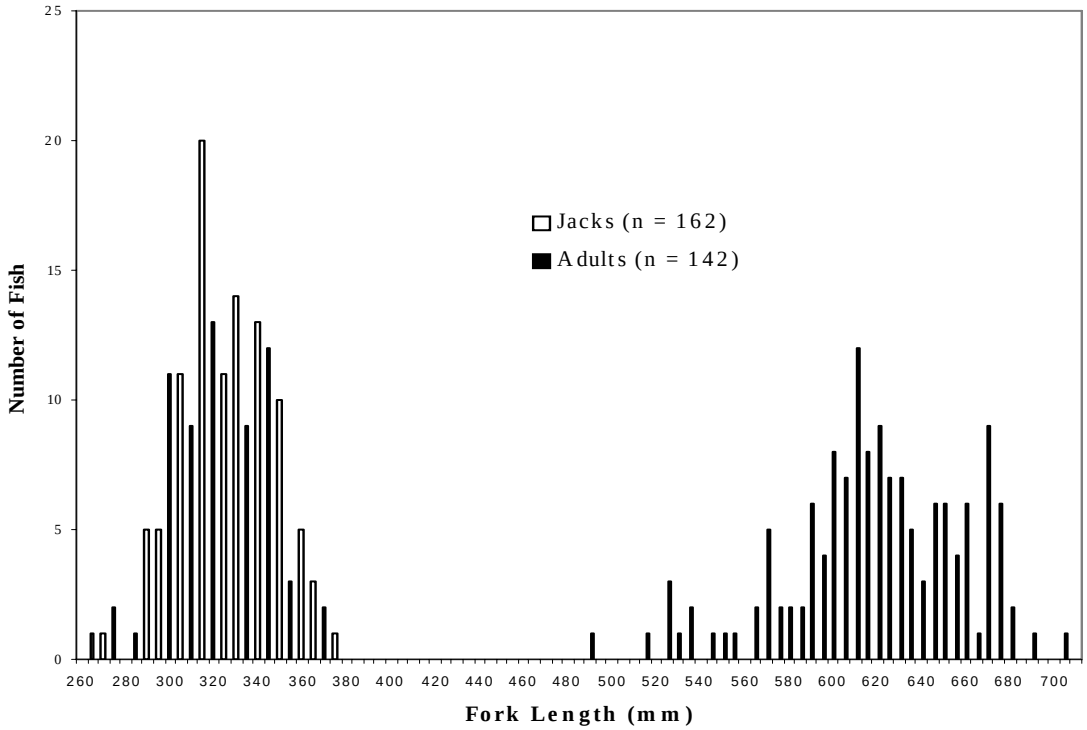

Figure 4.–Lengths of 304 mature coho salmon sampled at the Chuck Creek weir in 2004, by ocean age.

escapement was similar to previous years. Timing of the coho salmon escapement was also similar to that reported during weir operations in 1982, 1983, and 1985 (Integrated Fisheries Database, Commercial Fisheries Division, Douglas), and in 1950 (Edgington et al. 1981). A small number of mature coho salmon likely entered Chuck Creek after the weir was dismantled on October 14, however this number is likely a very small percentage of the total return as past weir operations have shown few fish return after this date (McCurdy 2005). In addition a small number of mature coho salmon may have moved past the weir uncounted on the morning of September 21 when a small portion of the weir was overtopped by high flows for a period of a couple of hours.

Despite the high flows on September 21, visibility remained good at this time and only one adult coho was observed passing over the weir (water clarity was sufficient for determination of a missing adipose fin on this fish).

Eighteen percent (18%) of the adult escapement and 21% of the jack escapement that was passed through the weir was successfully sampled for length and age (Table 5). The sample size was slightly higher for sex determination than age determination (Table 5), as sex was estimated on all fish sampled, but not all scale samples were readable due to some regenerated or otherwise unreadable scale samples. An estimated 42.6% (SE = 3.7%) of the 606 adult coho salmon counted in the escapement were male. The freshwater age of both jacks and adults was predominately age 1.x (1-year old smolt). Two-year-old smolt comprised an estimated 6.7% (SE = 2.1%) of the adult escapement and 14.1% (SE = 3.0%) of the jack escapement (Table 6).

In addition to the coho salmon escapement, a total of 2,550 adult sockeye salmon, 19 jack sockeye salmon (males < 400 mm FL), 123 chum salmon, and 10,642 pink salmon were counted through the weir between August 15 and October 14, 2004 (Appendix A2). Escapements were larger than weir counts for all species as an unknown number of sockeye and pink salmon passed upstream of the weir site before weir installation on August 14, and a number of pink and chum salmon spawned downstream of the weir site (personal observations).

RECOVERY OF CWTS AND ESTIMATES OF ADULT HARVEST, RUN, EXPLOITATION RATE, AND MARINE SURVIVAL

One of 142 adipose clipped adults sampled in the 2004 escapement did not retain its CWT. Thus, an estimated 472 escaping adults (= 141/142 x 475) had a CWT and the fraction of the adult escapement with CWTs (θ for harvest estimation) was 0.782 (= [472]/603).

A total of 222 adult coho salmon tagged as smolt emigrating from Chuck Creek in 2003 were recovered in creel and port sampling programs that sampled marine fisheries in 2004 (Appendix A3). There were no recoveries reported for marine fisheries in Canada. Of this total, 203 recoveries were random samples that were useful for estimating marine harvest in various fisheries (Table 7). The greatest number (175) of the random CWT recoveries of Chuck Creek coho was in the troll fishery and the remainder was in the seine fishery (16), and the sport fishery (12). There were also 14 random recoveries in the commercial fishery (Appendix A3). Of the

Table 5.–Escapement and sample size for sex and age by temporal strata, ocean age (adult/jack), and freshwater age of mature coho salmon passed through the Chuck Creek weir 2004.

			Number Sampled								
Strata (date)	Escapement		Adult males			Adult females			Jacks		
	adults	jacks	age 1.1	age 2.1	All[a]	age 1.1	age 2.1	All[a]	age 1.0	age 2.0	All[a]
1 (8/15-9/14)	336	388	16	1	24	30	1	39	52	9	81
2 (9/15-10/14)	270	218	28	1	38	27	5	41	60	9	81
Total	606	606	44	2	62	57	6	80	112	18	162

[a] Includes fish not successfully aged for freshwater age due to regenerated or unreadable scale samples.

Table 6.–Estimated number at age, age composition and mean length (mm FL) at age of adult and jack coho salmon in the escapement at Chuck Creek 2004.

	Adults			Jacks		
	Age 1.1	Age 2.1	All[a]	Age 1.0	Age 2.0	All[a]
Estimated Number	565	41	606	520	86	606
Percent	93.3	6.7	100	85.9	14.1	100
SE Percent	2.1	2.1	0	3	3	0
Mean Length	617.4	619.7	617.2	320.7	337.2	324.2
SE Mean Length	3.6	13.4	3.1	1.7	4	1.5

[a] Includes fish not successfully aged for freshwater age due to regenerated or unreadable scale samples.

random troll recoveries, 110 were recovered in the SW quadrant, 37 in the SE quadrant, 21 in the NW quadrant, and 7 in the NE quadrant (Appendix A4). Seine recoveries were in fishing Districts 102, 103, 104, and 109. Sport fish recoveries were from the port of Craig/Klawock.

The Southern Southeast Regional Aquaculture Association (SSRAA) recovered one additional coho salmon tagged as a smolt emigrating from Chuck Creek in 2003 at their Neck Lake facility on the Northeast coast of POW. The fish recovered by SSRAA was harvested in freshwater on July 24 as part of their cost-recovery operations on returning hatchery fish. The Neck Lake fish was not included in the harvest estimate because of the unusual behavior demonstrated by this fish (entering freshwater a month before Chuck Creek fish normally return, and in a location where Chuck Creek fish are rarely observed). Although this fish cannot be termed a stray (as it was harvested before it had the opportunity to spawn), this behavior is likely unique to this one fish and not representative of Chuck Creek fish in general.

Of the 223 adult coho salmon recovered in marine fisheries in 2004 containing coded wire tags from Chuck Creek (including the Neck Lake recovery, Appendix A3) 44 were from tag code 40528 (11,347 smolt tagged with this code) and the remaining 179 were from tag code 40529 (11,658 smolt tagged). The recovery rate of the tagged fish from the two different groups of smolt was significantly different (χ^2 = 78.9, df = 1, P < 0.001).

An estimated 980 (SE = 94) coho salmon originating from Chuck Creek were harvested in marine commercial and sport fisheries in 2004 (Table 7). The commercial troll fishery harvested an estimated 725 fish (74% of the total harvest) and the purse seine fishery harvested an estimated 179 fish, or 18% of the total harvest (Table 8). The sport fishery harvested an estimated 76 fish or 8% of the total. Harvested fish were sampled from early July through mid-September (Figure 5, Appendix A3).

The total run of Chuck Creek adult coho salmon was estimated at 1,586 fish (SE = 94) in 2004. Marine survival to adult of the 2003 smolt emigration was estimated at 5.4% (SE = 0.3%) and the exploitation rate in marine fisheries was estimated at 61.8% (SE = 2.2%). An additional 481 fish, or 1.6% (SE = 0.02%) of the estimated 29,302 smolt that emigrated in 2003 survived to return as jacks in the same year as their emigration.

DISCUSSION

MARINE SURVIVAL AND POTENTIAL BIAS IN SMOLT ABUNDANCE ESTIMATE

The smolt weir was operational prior to significant emigration in 2003 (Table 2, Figure 2), and it appeared to be virtually 100% effective at capturing coho salmon smolt while it was operating. However, an estimated 22% of the escapement from the 2003 smolt emigration was unmarked. The majority of these unmarked fish emigrated after the smolt weir was removed on May 24, 2003 (only a small number of captured smolt < 75 mm FL were released unmarked prior to weir removal). Therefore, it appears that all coho salmon smolt did not have an equal probability of being marked in this study.

The unequal probability of marking described above could lead to bias in the smolt abundance estimate if the marked and unmarked fish

Table 7.–Estimated marine harvest (r^i) of adult coho salmon bound for Chuck Creek in 2004. See text for details concerning notation.

TROLL FISHERY

Stat week	Dates (period)		Quad	Harvest	Var(H)	n^i	a^i	a^i	t^i	$t^{i'}$	m^i	r^i	SE(r^i)	RP(r^i)
27-33	7/1	8/9 (3)	NW	576,159	0	118,685	1,586	1,559	1,229	1,228	18	114	26	45%
34-40	8/12	9/30 (4)	NW	661,402	0	149,828	2,760	2,710	2,229	2,228	3	17	9	104%
27-33	7/1	8/9 (3)	NE	107,757	0	15,163	195	190	145	145	1	9	9	185%
34-40	8/12	9/30 (4)	NE	120,968	0	27,257	443	436	333	332	6	35	13	74%
27-33	7/1	8/9 (3)	SW	156,328	0	48,763	525	520	360	358	73	304	39	25%
34-40	8/12	9/30 (4)	SW	48,243	0	37,029	478	475	317	315	37	62	8	26%
27-33	7/1	8/9 (3)	SE	112,089	0	32,056	426	425	287	287	21	94	19	41%
34-40	8/12	9/30 (4)	SE	127,421	0	29,554	476	471	365	362	16	90	21	47%
Troll subtotal				1,910,367	0	458,335	6,889	6,786	5,265	5,255	175	725	59	16%

PURSE SEINE FISHERY

Stat week	Dates		District	Harvest	Var(H)	n^i	a^i	a^i	t^i	t^i	m^i	r^i	SE(r^i)	RP(r^i)
wk 29	7/11	7/17	102	4,213	0	1,236	21	21	14	14	1	4	4	172%
wk 36	8/29	9/4	102	1,978	0	533	4	4	3	3	1	5	4	174%
wk 32	8/1	8/7	103	2,237	0	485	1	1	1	1	1	6	5	179%
wk 33	8/8	8/14	103	1,900	0	247	1	1	1	1	1	10	9	186%
wk 34	8/15	8/21	103	2,826	0	87	3	3	3	2	1	62	62	194%
wk 30	7/18	7/24	104	17,428	0	5,733	54	54	36	36	3	12	6	98%
wk 31	7/25	7/31	104	23,481	0	4,876	55	53	33	33	5	32	13	82%
wk 33	8/8	8/14	104	11,385	0	974	7	6	3	3	2	35	24	135%
wk 32	8/1	8/7	109	9,610	0	902	16	16	15	15	1	14	13	189%
Purse Seine subtotal				75,058	0	15,073	162	159	109	108	16	179	70	77%

SPORT FISHERY

Biweek	Dates		Area	Harvest	Var(H)[a]	n^i	a^i	a^i	t^i	$t^{i'}$	m^i	r^i	SE(r^i)	RP(r^i)
bw 14	6/27	7/10	Craig	9,160		1,926	20	20	17	17	1	6	6	179%
bw 15	7/11	7/24	Craig	13,179		2,612	30	30	23	23	7	45	16	70%
bw 16	7/25	8/7	Craig	10,020		2,064	19	19	18	18	3	19	10	104%
bw 17	8/8	8/21	Craig	6,608		1,381	12	12	10	10	1	6	6	179%
Sport subtotal				38,967		7,983	81	81	68	68	12	76	22	58%
TOTAL ALL FISHERIES				2,024,392	0	481,391	7,132	7,026	5,442	5,431	203	980	94	19%

[a] Variance not estimated in Craig sport fisheries.

survived at different rates. Survival to maturity of coho salmon has been shown to be a function of smolt emigration timing and/or size at the time of emigration in other studies (Bilton et al. 1982; Lum 2003). Differences in survival rates between marked and unmarked smolt in this study cannot be tested for, although survival among *marked* fish was likely a function of emigration date, as described below.

Tagged coho salmon smolt from the 2003 Chuck Creek emigration can be divided into two groups based on their date of emigration (date of capture). Smolt captured from April 15 until May 7 were given CWT code 040528 and smolt captured from May 7 until May 24 were given code 040529. The later group of tagged fish were captured in the marine fisheries at about four times the rate of fish marked early in the emigration (Appendix A3); of the 223 fish recovered in marine fisheries (including the Neck Lake fish) with a CWT, 44 (20%) were from *early emigrants* and 179 (80%) were from *later emigrants*. This difference is statistically significant. Also, there is a small sample of "select" (as compared to random or systematically sampled) CWT fish collected from carcasses in

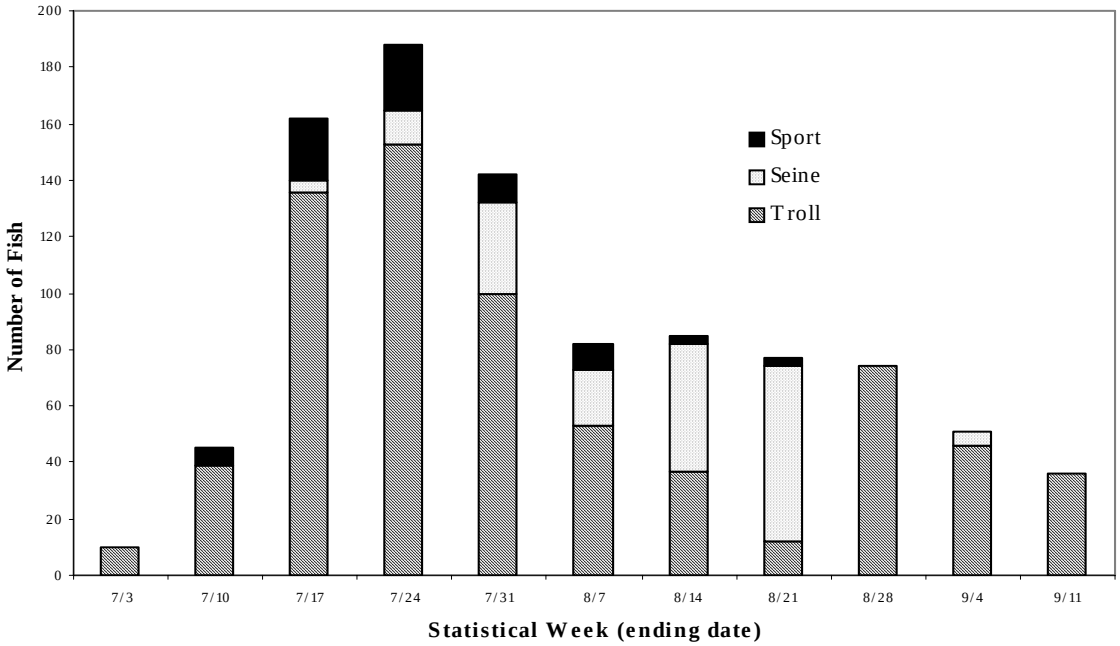

Figure 5.–Estimated marine harvest of coho salmon bound for Chuck Creek by statistical week and fishery in 2004**.**

the escapement four early emigrants (20%) and 16 late emigrants (80%), from 15 jacks in 2003 and five adults in 2004 (Appendix A3). Although the escapement sample is small and nonrandom, the ratio of early and late emigrants is not significantly different from those recovered in marine fisheries (χ^2 = 0.0008, df = 1, P = 0.98). The different recovery rates of the two tag groups could be explained if they were not well mixed in space and time as they entered marine fisheries (and were therefore harvested at different rates). An examination of marine recoveries of the two tag groups in marine fisheries at a finer scale (Table 9) suggest substantial mixing, with no indication that one tag group had a significantly different spatial or temporal migration pattern than the other. Thus, differential marine survival appears to be the cause for the different recovery rates of the two groups of tagged fish.

If it is presumed that the number of adipose-clipped fish in the escapement (477 = [606 x (475/603)]) had the same proportion of tag codes observed in the marine fisheries (44 early emigrants, 179 late emigrants), then separate estimates of marine survival for the two groups of tagged emigrants can be obtained such that the number of tagged adults in the escapement is an estimated 94 early emigrants (= 477 x [44/223]) and 383 late emigrants (= 477 x [179/223]). Under this model, the marine survival of the early-emigrating *tagged* fish was 2.7% and the rate for late-emigrating *tagged* fish was 8.0% (Table 10). Because most of the unmarked fish in this experiment emigrated after the weir was removed on May 24, they may have experienced a different survival rate than the marked fish. Lum (2003) reported that survival (to maturity as either jack or adult) of wild Auke Creek coho smolt decreased with increased emigration date. Although Lum's (2003) result differs from this study (where a later-emigration date appeared to favor survival), both results suggest a temporal window existed for optimal marine survival.

Although there are only two years worth of smolt emigration data at Chuck Creek for comparison, the 2003 emigration appeared to occur earlier than the 2002 emigration (Figure 6). Water temperature has been demonstrated to be a factor influencing coho salmon smolt migration in other studies (Hoar 1951; Blackwell et al. 1999) and

Table 8.–Estimated harvest, exploitation, and total run of Chuck Creek coho salmon in 2004**.**

Fishery	Area	Estimated harvest	SE	Percent of marine harvest	Percent of total run
Troll	NW Quadrant	131	28	13.4	8.3
	NE Quadrant	44	16	4.5	2.8
	SW Quadrant	366	40	37.3	23.1
	SE Quadrant	184	29	18.8	11.6
	subtotal	725	59	74.0	45.7
Seine	District 102	9	6	0.9	0.6
	District 103	78	63	8.0	4.9
	District 104	78	28	8.0	4.9
	District 109	14	13	1.4	0.9
	subtotal	179	70	18.3	11.3
Sport	Craig/Klawock	76	22	7.8	4.8
	subtotal	76	22	7.8	4.8
Total harvest		980	94	100.0	61.8
Escapement		606			38.2
Total Run		1,586			100.0

Table 9.–Ratio of tag-code recoveries (code 040528-early/code 040529-late) from Chuck Creek coho salmon in marine fisheries in 2004 by fishing district and statistical week (where the fishing district was identified).

	Statistical Week										
	28	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**Total**
District											
102	0/0	0/2	0/0	0/0	0/0	0/0	0/0	0/0	0/1	0/0	0/3
103	1/2	0/2	1/3	0/1	0/1	0/2	1/0	0/0	2/1	0/0	5/12
104	0/1	3/9	6/28	4/10	1/2	2/7	1/1	2/5	0/2	0/1	19/66
105	0/0	0/1	0/4	0/9	2/4	1/4	0/1	3/3	0/1	0/3	6/30
106	0/0	0/0	0/1	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/1
109	0/0	0/0	0/0	0/1	1/0	0/0	0/0	0/3	1/1	0/0	2/5
113	0/1	1/8	0/2	0/1	1/0	0/0	0/0	0/0	0/2	1/1	3/15
114	0/1	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/1
152	0/0	0/0	0/0	1/1	1/2	0/0	0/1	1/3	1/2	0/0	4/9
154	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	1/0
157	0/0	0/1	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/1
Total	1/5	4/23	7/38	6/23	6/9	3/13	2/3	6/14	4/10	1/5	40/143

Table 10.–Estimated marine harvest, escapement, and survival to adult by tag code of coded wire tagged coho salmon from the 2003 Chuck Creek smolt emigration.

CWT Group	Tag code	# Smolt	# Harvested[a]	# Escapement[b]	Total adults	Survival
Early	040528	11,347	216	94	310	2.70%
Later	040529	11,658	551[c]	383	934	8.01%

[a] The sum of harvest (rij) of coded wire tagged fish across strata (without expanding for untagged fish).

[b] Assumes adipose-clipped fish in the escapement had the same proportion of tag codes as observed in sampled marine fisheries.

[c] Includes the Neck Lake coded wire tagged fish, but does not expand this recovery for non-sampled adipose clipped fish in this stratum.

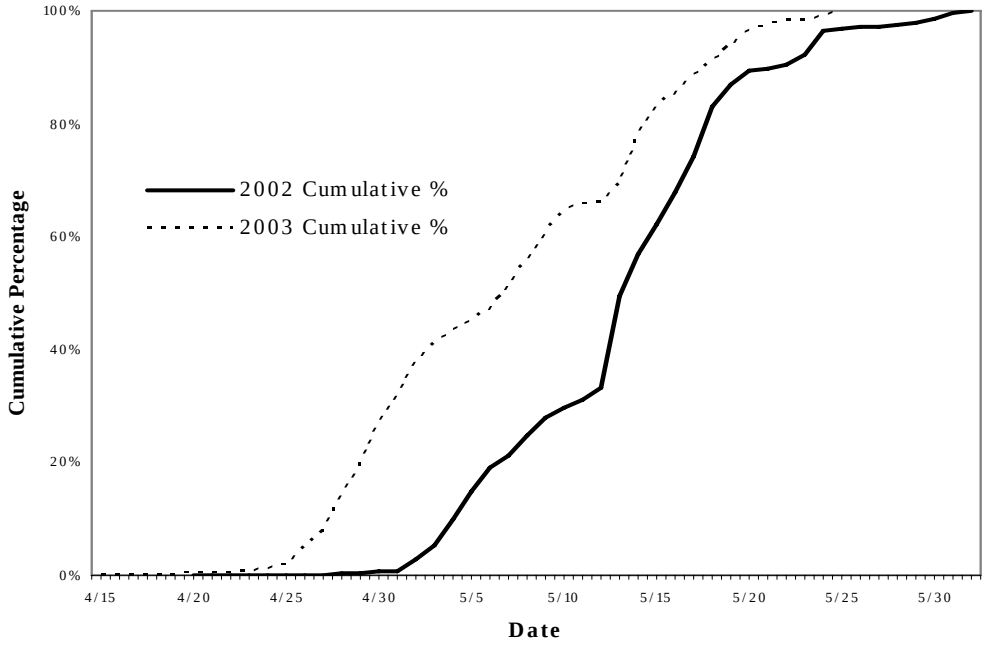

Figure 6.–Cumulative percentages of the coho salmon smolt emigrations captured at Chuck Creek in 2002 and 2003 by date.

may have been a factor in the early emigration from Chuck Creek that occurred in 2003. Water temperatures in Chuck Creek in late April 2003 were several degrees warmer than for the same time period the previous year (Figure 7).

Smolt from two releases (or emigration) groups might also exhibit different survival rates because one group was larger in size, on average, than the other. In this study, smolt that migrated prior to May 7 averaged 96 mm in fork length (SE= 11.4) and those that migrated later averaged 98 mm FL (SE = 10.4). While this difference is statistically significant (F = 4.011, df = 1, P = 0.045), it is unlikely that this small difference in length (2 mm in average length) led to the large apparent difference in marine survival of the two tagged groups. Thus, the most likely cause of the differential survival between the two tagged groups was their date of entry into the marine environment, where early emigrants may have experienced poorer marine conditions for growth and/or higher predation rates.

In this study, survival (to either jack or adult) of *marked* fish was estimated to be 7.0% (= [$376_{\text{cwt jacks}}$ + $477_{\text{cwt adult esc}}$ + $767_{\text{cwt harvest}}$] / $23{,}005_{\text{cwt smolt}}$).

A simple simulation was used to estimate potential bias in the smolt abundance estimate due to unmarked fish surviving at a rate other than 7.0%:

$$\hat{N} = n_{marked} + \left(m_{unmarked} / S_{unmarked}\right) \qquad (22)$$

where $\hat{N}$ is the mark-recapture estimate of smolt abundance, n_{marked} is the number of smolt that were marked (23,019), $m_{unmarked}$ is the number of unmarked mature fish (in both the escapement and harvest, estimated at 441 in this study, assuming the exploitation rate for unmarked fish is the same for marked fish), and *S* is the fraction of unmarked smolt that survive to maturity (unknown in this study). If unmarked fish survived at 8.8% (a rate 25% higher than the rate for marked fish) then the smolt abundance estimate would be biased by 4.5% (and the actual abundance would be 28,046), and if the actual survival rate for unmarked fish was 5.3% (25% lower than for marked fish) the smolt abundance estimate would be biased by 6.6% (an abundance of 31,397). These simulations suggest it would require a large difference in survival rates between marked and

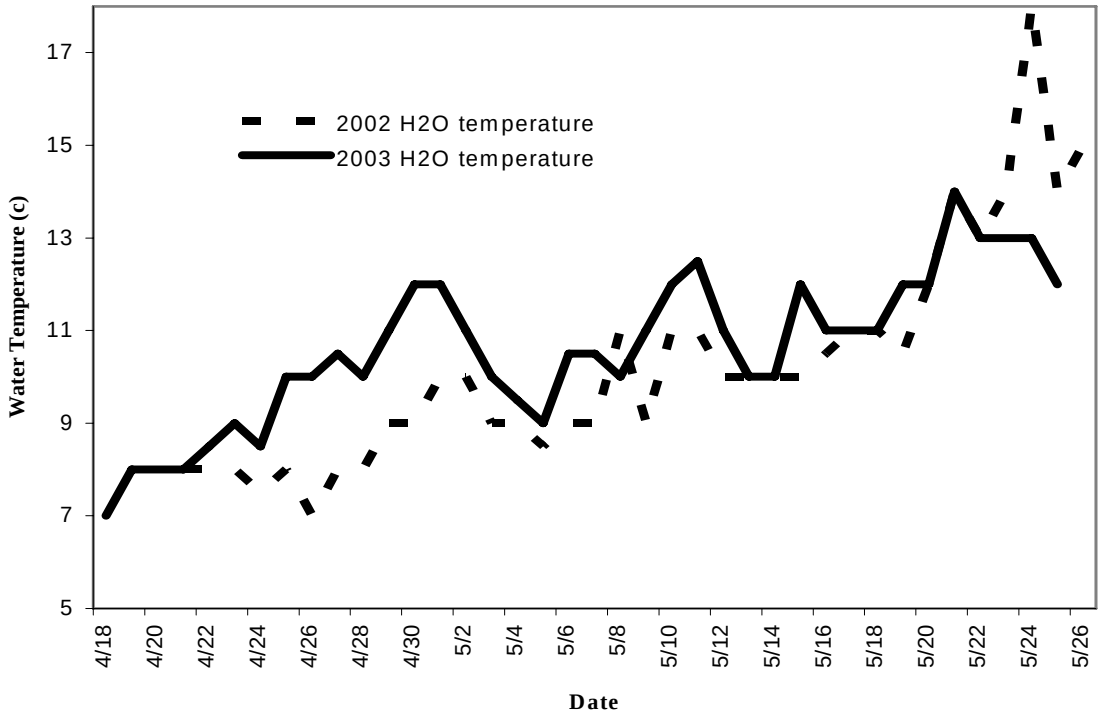

Figure 7.–Chuck Creek daily water temperatures measured at 8:00 AM at the smolt weir site, 2002–2003.

unmarked fish to greatly bias the smolt abundance estimate.

The age composition of the coho salmon smolt sampled in the 2003 Chuck Creek emigration was almost identical to the composition of the sampled fish from the 2002 emigration (i.e. 76.5% age-1, and 23.5% age-2. McCurdy 2005), however the mean fork length of the sampled fish in 2003 was considerably smaller than 2002. The fork length of age-1 smolt in 2003 was 10.1 mm smaller than age-1 fish in 2002, age-2 smolt were 11.6 mm smaller, and overall (all ages combined) coho salmon smolt in 2003 were 10.4 mm smaller than those sampled the previous year.

The estimated marine survival rate to adults of 5.4% for Chuck Creek coho salmon in 2004 is poor, and is less than half the estimated survival rate of the Chuck Creek coho salmon from the previous year (11.9% McCurdy 2005). Marine survival of coho salmon has been shown to be positively correlated to smolt size in other studies (Bilton et al. 1982; Lum 2003), and the smaller size of smolt that emigrated from Chuck Creek in 2003 likely contributed to their lower survival rate.

BROOD YEAR PRODUCTION

The estimated smolt emigration of 29,302 in 2003 consisted of an estimated 22,255 age-1 smolt (76.0% of the emigration) that resulted from the 2001 escapement of 1,350 adults (McCurdy 2005), and 7,047 age-2 smolt (24.0% of the emigration) that resulted from an un-monitored escapement in 2000. Because the age composition for unmarked smolt in this study is unknown, the above estimate for the entire emigration is biased if the age composition differs between marked and unmarked smolt.

MARINE HARVEST

The marine exploitation rate of 61.8% in 2004 of Chuck Creek coho was very similar to the 2003 rate of 58.7% (McCurdy 2005) and also similar to that reported in the early 1980s (Shaul et al. 1991). Other than the one fish harvested in Neck Lake in 2004, harvest distribution patterns in 2004

were also similar to past years (McCurdy 2005; Shaul et al. 1991) in that almost all harvest occurred in districts along the outside coast (Appendixes A3, A4).

RECOMMENDATIONS

To ensure all juvenile coho salmon captured were indeed smolt and would not remain in fresh water for another year, operational planning for this project called for coded wire tagging only coho salmon smolt ≥75 mm FL. In 2002 (the only other year of smolt tagging) this was not a concern as no smolt were captured smaller than this size. However, in 2003 several dozen smolt <75 mm were captured and released untagged. In hindsight, this is an unnecessary precaution as the method and location of capture virtually ensure that all juvenile coho captured are migrating to the marine environment.

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APPENDIX A

Appendix A1.–Daily escapement counts of mature coho salmon through the weir on Chuck Creek by life history type and mark status (adipose fin removed), 2004.

	Adults (age x.1)				Jacks (age x.0)		
Date	**Marked**	**Unmarked**	**Unknown**	**Total**	**Marked**	**Unmarked**	**Total**
8/15	0	0	0	0	0	0	0
8/16	0	0	0	0	0	0	0
8/17	0	0	0	0	0	0	0
8/18	0	0	0	0	0	0	0
8/19	0	0	0	0	0	0	0
8/20	0	0	0	0	0	0	0
8/21	0	0	0	0	0	0	0
8/22	0	0	0	0	0	0	0
8/23	0	0	0	0	0	0	0
8/24	0	0	0	0	0	0	0
8/25	0	0	0	0	0	0	0
8/26	0	0	0	0	0	0	0
8/27	0	1	0	1	0	0	0
8/28	1	0	0	1	0	0	0
8/29	0	0	0	0	1	0	1
8/30	0	0	0	0	1	0	1
8/31	0	0	0	0	1	0	1
9/1	0	0	0	0	0	0	0
9/2	1	0	0	1	2	0	2
9/3	18	6	0	24	16	2	18
9/4	67	7	0	74	28	0	28
9/5	29	8	0	37	11	0	11
9/6	15	4	0	19	23	2	25
9/7	28	2	0	30	36	5	41
9/8	31	2	0	33	30	1	31
9/9	27	6	0	33	39	1	40
9/10	13	3	0	16	58	4	62
9/11	22	11	0	33	26	1	27
9/12	12	3	0	15	27	3	30
9/13	9	4	0	13	44	6	50
9/14	4	2	0	6	20	0	20
9/15	12	3	0	15	29	2	31
9/16	8	4	0	12	23	2	25
9/17	2	1	0	3	7	0	7
9/18	1	1	0	2	6	1	7
9/19	2	1	0	3	6	0	6
9/20	2	2	0	4	20	2	22
9/21	11	0	0	11	3	0	3
9/22	69	14	0	83	17	4	21
9/23	28	8	0	36	12	3	15
9/24	24	6	0	30	7	3	10
9/25	13	6	0	19	11	3	14
9/26	3	6	0	9	2	4	6
9/27	9	2	0	11	5	3	8
9/28	5	5	0	10	4	4	8
9/29	7	4	0	11	6	1	7
9/30	0	1	0	1	2	0	2
10/1	0	0	0	0	1	1	2
10/2	1	0	0	1	0	0	0
10/3	1	0	0	1	1	0	1

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Appendix A1.–Page 2 of 2.

	Adults (age x.1)				Jacks (age x.0)		
Date	**Marked**	**Unmarked**	**Unknown**	**Total**	**Marked**	**Unmarked**	**Total**
10/4	0	0	0	0	0	2	2
10/5	0	0	0	0	1	4	5
10/6	0	2	0	2	0	2	2
10/7	0	1	0	1	2	5	7
10/8	0	0	0	0	0	1	1
10/9	0	0	0	0	0	0	0
10/10	0	1	0	1	0	0	0
10/11	0	0	0	0	0	1	1
10/12	0	1	0	1	1	3	4
10/13	0	0	0	0	1	0	1
10/14	0	0	3[a]	3	0	0	0
Totals	**475**	**128**	**3**	**606**	**530**	**76**	**606**

[a] Fish holding downstream of the weir when it was dismantled at the end of the season.

Appendix A2.–Daily escapement counts of mature sockeye, pink and chum salmon through the weir at Chuck Creek in 2004.

Date	Sockeye Adults	Sockeye Jacks[a]	Pink	Chum
8/15/2004	58	1	0	0
8/16/2004	120	1	7	0
8/17/2004	124	3	16	0
8/18/2004	36	1	17	0
8/19/2004	150	0	22	0
8/20/2004	125	0	24	0
8/21/2004	118	0	37	0
8/22/2004	241	0	31	0
8/23/2004	132	3	84	0
8/24/2004	52	0	485	0
8/25/2004	38	0	209	0
8/26/2004	122	0	250	1
8/27/2004	242	0	1,035	0
8/28/2004	89	1	697	0
8/29/2004	148	0	605	0
8/30/2004	214	0	1,287	0
8/31/2004	58	0	758	0
9/1/2004	83	0	595	0
9/2/2004	45	1	597	0
9/3/2004	78	2	529	0
9/4/2004	55	2	421	1
9/5/2004	21	0	93	1
9/6/2004	32	0	99	0
9/7/2004	37	2	436	0
9/8/2004	51	1	414	3
9/9/2004	14	0	49	1
9/10/2004	8	0	38	0
9/11/2004	4	0	18	1
9/12/2004	1	0	19	6
9/13/2004	10	0	70	6
9/14/2004	4	0	46	4
9/15/2004	5	1	31	3
9/16/2004	0	0	33	1
9/17/2004	1	0	45	1
9/18/2004	2	0	77	0
9/19/2004	3	0	71	0
9/20/2004	19	0	354	0
9/21/2004	0	0	279	13
9/22/2004	3	0	305	32
9/23/2004	1	0	67	12
9/24/2004	0	0	77	13
9/25/2004	2	0	47	1
9/26/2004	0	0	29	10
9/27/2004	0	0	34	0
9/28/2004	0	0	37	4
9/29/2004	1	0	38	2
9/30/2004	2	0	28	1
10/1/2004	0	0	9	2
10/2/2004	1	0	9	1
10/3/2004	0	0	7	0
10/4/2004	0	0	13	0

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Appendix A2.–Page 2 of 2.

Date	Sockeye Adults	Sockeye Jacks[a]	Pink	Chum
10/5/2004	0	0	11	0
10/6/2004	0	0	15	1
10/7/2004	0	0	10	0
10/8/2004	0	0	8	0
10/9/2004	0	0	3	0
10/10/2004	0	0	7	0
10/11/2004	0	0	3	1
10/12/2004	0	0	1	0
10/13/2004	0	0	6	1
10/14/2004	0	0	0	0
Totals	2,550	19	10,642	123

[a] Fish < 400 mm FL.

Appendix A3.–Random and non-random recoveries of coho salmon that were coded wire tagged during spring 2003 at Chuck Creek.

Head Number	Tag Code	Sampling Port	Gear	Recovery Date	Stat Week	Quad	District	Sub-Dist.	Length (mm)
RANDOM FISHERIES RECOVERIES									
144792	40529	Neck Lake	Trap	7/24/2004	30	SE	106	35	
285092	40529	Ketchikan	Seine	7/12/2004	29	SE	102		585
258170	40529	Ketchikan	Seine	7/20/2004	30	SW	104	35	610
258171	40529	Ketchikan	Seine	7/20/2004	30	SW	104	35	680
258037	40529	Ketchikan	Seine	7/24/2004	30	SW	104	10	677
258465	40528	Ketchikan	Seine	7/28/2004	31	SW	104		650
535214	40529	Petersburg	Seine	7/28/2004	31	SW			626
258494	40529	Ketchikan	Seine	7/29/2004	31	SW	104		600
258476	40529	Ketchikan	Seine	7/29/2004	31	SW	104		630
258495	40529	Ketchikan	Seine	7/29/2004	31	SW	104		635
258482	40529	Ketchikan	Seine	7/29/2004	31	SW	104		648
535246	40529	Petersburg	Seine	7/31/2004	31	SW			564
535249	40529	Petersburg	Seine	7/31/2004	31	SW			597
534579	40529	Petersburg	Seine	8/4/2004	32	SW	103	80	557
534793	40528	Petersburg	Seine	8/6/2004	32	NE	109	51	638
258328	40528	Ketchikan	Seine	8/9/2004	33	SW	104		655
535167	40528	Petersburg	Seine	8/10/2004	33	SW	104	40	619
535171	40529	Petersburg	Seine	8/12/2004	33	SW	103	80	509
535187	40528	Petersburg	Seine	8/18/2004	34	SW	103	80	690
535284	40528	Petersburg	Seine	8/20/2004	34	SW			521
285562	40529	Ketchikan	Seine	9/2/2004	36	SE	102	50	768
266032	40529	Pelican	Troll	7/3/2004	27	NW			587
263362	40529	Sitka	Troll	7/4/2004	28	NW	113	41	589
249431	40529	Sitka	Troll	7/7/2004	28	NW	114	21	601
283759	40529	Craig	Troll	7/7/2004	28	SW	103	70	637
283350	40529	Craig	Troll	7/9/2004	28	SW	104	40	570
538136	40528	Excursion Inlet	Troll	7/10/2004	28	NW			675
283365	40528	Craig	Troll	7/10/2004	28	SW	103	70	643
249346	40529	Sitka	Troll	7/11/2004	29	NW	113		603
283789	40529	Craig	Troll	7/11/2004	29	SW	103	70	645
283400	40529	Craig	Troll	7/11/2004	29	SW	104	35	610
283782	40529	Craig	Troll	7/11/2004	29	SW	104	35	625
283783	40529	Craig	Troll	7/11/2004	29	SW	104	35	635
263781	40528	Sitka	Troll	7/12/2004	29	NW	113	31	663
257254	40529	Ketchikan	Troll	7/12/2004	29	SW			634
257257	40529	Ketchikan	Troll	7/12/2004	29	SW			645
257265	40528	Ketchikan	Troll	7/12/2004	29	SW			684
249499	40529	Sitka	Troll	7/13/2004	29	NW			615
283105	40529	Craig	Troll	7/13/2004	29	SE	102	10	615
249646	40529	Sitka	Troll	7/15/2004	29	NW	113	45	583
266282	40529	Pelican	Troll	7/15/2004	29	NW	113	91	612
283139	40529	Craig	Troll	7/15/2004	29	SW			642
262419	40529	Sitka	Troll	7/16/2004	29	NW	113	21	635
273634	40529	Hoonah	Troll	7/16/2004	29	NW	113	91	560
273714	40529	Hoonah	Troll	7/16/2004	29	NW	113	93	615
534706	40529	Petersburg	Troll	7/16/2004	29	SE	105	50	567
283815	40529	Craig	Troll	7/16/2004	29	SW	104	35	615

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Head Number	Tag Code	Sampling Port	Gear	Recovery Date	Stat Week	Quad	District	Sub-Dist.	Length (mm)
RANDOM FISHERIES RECOVERIES									
283817	40529	Craig	Troll	7/16/2004	29	SW	104	35	632
286805	40529	Craig	Troll	7/16/2004	29	SW	104	40	582
286813	40529	Craig	Troll	7/16/2004	29	SW	104	40	672
286837	40528	Craig	Troll	7/16/2004	29	SW	104	30	632
283178	40528	Craig	Troll	7/16/2004	29	SW	104	35	665
262485	40529	Sitka	Troll	7/17/2004	29	NW	113	45	625
266465	40529	Pelican	Troll	7/19/2004	30	NW	113	91	578
286844	40529	Craig	Troll	7/20/2004	30	SW	104	35	565
286851	40528	Craig	Troll	7/20/2004	30	SW	103	70	610
283876	40529	Craig	Troll	7/21/2004	30	SW	104	35	635
258456	40529	Ketchikan	Troll	7/21/2004	30	SW			617
258439	40529	Ketchikan	Troll	7/21/2004	30	SW			618
258452	40529	Ketchikan	Troll	7/21/2004	30	SW			640
258451	40529	Ketchikan	Troll	7/21/2004	30	SW			641
258453	40529	Ketchikan	Troll	7/21/2004	30	SW			645
258458	40529	Ketchikan	Troll	7/21/2004	30	SW			650
258457	40529	Ketchikan	Troll	7/21/2004	30	SW			657
258455	40529	Ketchikan	Troll	7/21/2004	30	SW			663
265089	40529	Port Alexander	Troll	7/22/2004	30	NW	113	11	629
283883	40529	Craig	Troll	7/22/2004	30	SE	105	50	650
286857	40529	Craig	Troll	7/22/2004	30	SW	104	40	625
286872	40529	Craig	Troll	7/22/2004	30	SW	104	40	635
286860	40529	Craig	Troll	7/22/2004	30	SW	104	40	643
286859	40529	Craig	Troll	7/22/2004	30	SW	104	40	650
286880	40529	Craig	Troll	7/22/2004	30	SW	104	40	655
286873	40529	Craig	Troll	7/22/2004	30	SW	104	50	614
286862	40528	Craig	Troll	7/22/2004	30	SW	104	40	640
283604	40529	Craig	Troll	7/23/2004	30	SE	105	10	634
286715	40529	Craig	Troll	7/23/2004	30	SE	105	10	635
286714	40529	Craig	Troll	7/23/2004	30	SE	105	10	645
283891	40529	Craig	Troll	7/23/2004	30	SW	104	35	550
286915	40529	Craig	Troll	7/23/2004	30	SW	104	35	613
286912	40529	Craig	Troll	7/23/2004	30	SW	104	35	627
286888	40529	Craig	Troll	7/23/2004	30	SW	104	40	576
286713	40529	Craig	Troll	7/23/2004	30	SW	104	40	595
286942	40529	Craig	Troll	7/23/2004	30	SW	104	40	603
286941	40529	Craig	Troll	7/23/2004	30	SW	104	40	616
286950	40529	Craig	Troll	7/23/2004	30	SW	104	40	637
286944	40529	Craig	Troll	7/23/2004	30	SW	104	40	670
286891	40528	Craig	Troll	7/23/2004	30	SW	104	40	605
286709	40528	Craig	Troll	7/23/2004	30	SW	104	40	626
286885	40528	Craig	Troll	7/23/2004	30	SW	104	40	711
283609	40529	Craig	Troll	7/24/2004	30	SW	103	70	568
286733	40529	Craig	Troll	7/24/2004	30	SW	104	35	576
286748	40529	Craig	Troll	7/24/2004	30	SW	104	35	596
286755	40529	Craig	Troll	7/24/2004	30	SW	104	35	643
286750	40529	Craig	Troll	7/24/2004	30	SW	104	35	672
283613	40529	Craig	Troll	7/24/2004	30	SW	104	50	644

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Head Number	Tag Code	Sampling Port	Gear	Recovery Date	Stat Week	Quad	District	Sub-Dist.	Length (mm)
RANDOM FISHERIES RECOVERIES									
283616	40529	Craig	Troll	7/24/2004	30	SW	104	50	645
283611	40529	Craig	Troll	7/24/2004	30	SW	104	50	677
286752	40528	Craig	Troll	7/24/2004	30	SW	104	35	610
283614	40528	Craig	Troll	7/24/2004	30	SW	104	50	600
263846	40529	Sitka	Troll	7/25/2004	31	NW	113	31	575
262584	40528	Sitka	Troll	7/25/2004	31	NW	154		624
262638	40529	Sitka	Troll	7/27/2004	31	NE	109	61	654
283621	40528	Craig	Troll	7/27/2004	31	SW	152		610
534763	40529	Petersburg	Troll	7/28/2004	31	SE	105	10	565
534767	40529	Petersburg	Troll	7/28/2004	31	SE	105	10	663
283636	40529	Craig	Troll	7/28/2004	31	SW	104	40	551
286970	40529	Craig	Troll	7/28/2004	31				639
286783	40529	Craig	Troll	7/29/2004	31	SE	105	10	608
286979	40529	Craig	Troll	7/29/2004	31	SE	105	10	634
286978	40529	Craig	Troll	7/29/2004	31	SE	105	10	656
286983	40529	Craig	Troll	7/29/2004	31	SE	105	10	662
286973	40529	Craig	Troll	7/29/2004	31	SE	105	10	682
286986	40529	Craig	Troll	7/29/2004	31	SE	105	50	621
286984	40529	Craig	Troll	7/29/2004	31	SE	105	50	668
286988	40529	Craig	Troll	7/30/2004	31	SW	104	40	555
283205	40529	Craig	Troll	7/30/2004	31	SW	104	50	623
283217	40529	Craig	Troll	7/30/2004	31	SW	104	50	624
283207	40529	Craig	Troll	7/30/2004	31	SW	104	50	676
286994	40528	Craig	Troll	7/30/2004	31	SW	104	40	700
286606	40529	Craig	Troll	7/31/2004	31	SW	104	35	615
283659	40529	Craig	Troll	7/31/2004	31	SW	152		604
286605	40528	Craig	Troll	7/31/2004	31	SW	104	35	644
283668	40529	Craig	Troll	8/2/2004	32	SE	105		666
283666	40528	Craig	Troll	8/2/2004	32	SE	105		675
286620	40529	Craig	Troll	8/2/2004	32	SW			541
283228	40529	Craig	Troll	8/3/2004	32	SE	105	10	629
283244	40529	Craig	Troll	8/3/2004	32	SE	105	10	630
286631	40529	Craig	Troll	8/4/2004	32	SE	105	10	637
286641	40529	Craig	Troll	8/4/2004	32	SW	152		655
286643	40528	Craig	Troll	8/4/2004	32	SW	152		662
265274	40529	Port Alexander	Troll	8/4/2004	32				648
286655	40529	Craig	Troll	8/5/2004	32	SW	104	40	636
286656	40528	Craig	Troll	8/5/2004	32	SW	104	40	665
283290	40528	Craig	Troll	8/5/2004	32				640
283291	40528	Craig	Troll	8/5/2004	32				665
283289	40529	Craig	Troll	8/5/2004	32				614
283285	40529	Craig	Troll	8/5/2004	32				628
283286	40529	Craig	Troll	8/5/2004	32				665
283907	40528	Craig	Troll	8/6/2004	32	SE	105	50	622
283917	40529	Craig	Troll	8/6/2004	32	SW	152		694
249709	40528	Sitka	Troll	8/7/2004	32	NW	113	31	706
286516	40529	Craig	Troll	8/8/2004	33	SE	105	10	636
286517	40529	Craig	Troll	8/8/2004	33	SE	105	10	643

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Head Number	Tag Code	Sampling Port	Gear	Recovery Date	Stat Week	Quad	District	Sub-Dist.	Length (mm)
RANDOM FISHERIES RECOVERIES									
283925	40529	Craig	Troll	8/8/2004	33	SW	103	90	654
286506	40529	Craig	Troll	8/8/2004	33	SW	104	40	590
285420	40529	Ketchikan	Troll	8/8/2004	33	SW			566
285448	40529	Ketchikan	Troll	8/8/2004	33	SW			646
285426	40529	Ketchikan	Troll	8/8/2004	33	SW			650
285434	40529	Ketchikan	Troll	8/8/2004	33	SW			652
285447	40528	Ketchikan	Troll	8/8/2004	33	SW			675
283939	40529	Craig	Troll	8/9/2004	33	SE	105	50	633
283938	40528	Craig	Troll	8/9/2004	33	SE	105	50	633
283692	40529	Craig	Troll	8/10/2004	33	SE	105	50	623
286528	40529	Craig	Troll	8/10/2004	33	SW	104	40	570
286534	40529	Craig	Troll	8/10/2004	33	SW	104	40	657
286544	40529	Craig	Troll	8/10/2004	33	SW	104		604
286551	40529	Craig	Troll	8/10/2004	33	SW	104		610
286554	40529	Craig	Troll	8/10/2004	33	SW	104		613
283952	40529	Craig	Troll	8/14/2004	33	SW	104	40	631
286408	40529	Craig	Troll	8/16/2004	34	SW	104	40	619
286693	40529	Craig	Troll	8/19/2004	34	SW	152		641
535310	40529	Petersburg	Troll	8/21/2004	34	SE	105	41	650
265423	40529	Port Alexander	Troll	8/23/2004	35	NE	109		657
535319	40529	Petersburg	Troll	8/23/2004	35	NE			625
286472	40529	Craig	Troll	8/23/2004	35				637
286207	40529	Craig	Troll	8/24/2004	35	SE	105	10	690
284146	40529	Craig	Troll	8/24/2004	35	SW	152		635
286218	40528	Craig	Troll	8/24/2004	35	SW	104	40	660
286484	40528	Craig	Troll	8/24/2004	35	SW	104	50	603
261031	40529	Sitka	Troll	8/25/2004	35	NE	109	61	637
286234	40529	Craig	Troll	8/25/2004	35	SE	105	10	619
284159	40529	Craig	Troll	8/25/2004	35	SE	105	10	660
286239	40528	Craig	Troll	8/25/2004	35	SE	105	10	676
286240	40528	Craig	Troll	8/25/2004	35	SE	105	10	725
284148	40529	Craig	Troll	8/25/2004	35	SW	104	40	657
286248	40529	Craig	Troll	8/26/2004	35	SW	104	40	644
535337	40529	Petersburg	Troll	8/27/2004	35	NE	109	61	645
286263	40528	Craig	Troll	8/27/2004	35	SE	105	10	653
286295	40529	Craig	Troll	8/27/2004	35	SW	104	50	631
286299	40529	Craig	Troll	8/27/2004	35	SW	104	50	647
284169	40529	Craig	Troll	8/28/2004	35	SW	104	50	631
286115	40529	Craig	Troll	8/28/2004	35	SW	152		558
286111	40529	Craig	Troll	8/28/2004	35	SW	152		614
286102	40528	Craig	Troll	8/28/2004	35	SW	152		709
535347	40529	Petersburg	Troll	8/30/2004	36	NE	109		636
266942	40529	Pelican	Troll	8/30/2004	36	NW	113	91	642
261096	40529	Sitka	Troll	8/30/2004	36	SE	105	50	661
286134	40529	Craig	Troll	8/30/2004	36				679
286125	40529	Craig	Troll	8/30/2004	36				860
286147	40528	Craig	Troll	8/31/2004	36	NE	109	10	726
286168	40529	Craig	Troll	8/31/2004	36	SW	103	70	656

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Head Number	Tag Code	Sampling Port	Gear	Recovery Date	Stat Week	Quad	District	Sub-Dist.	Length (mm)
RANDOM FISHERIES RECOVERIES									
286164	40529	Craig	Troll	8/31/2004	36	SW			632
286161	40529	Craig	Troll	8/31/2004	36	SW			657
286169	40528	Craig	Troll	8/31/2004	36	SW	103	70	564
286170	40528	Craig	Troll	8/31/2004	36	SW	103	70	651
284305	40529	Craig	Troll	9/1/2004	36	SW	104	35	639
284304	40529	Craig	Troll	9/1/2004	36	SW	104	35	646
284223	40529	Craig	Troll	9/1/2004	36	SW	152		674
260392	40529	Sitka	Troll	9/2/2004	36	NW	113	61	692
284254	40529	Craig	Troll	9/2/2004	36	SW	152		647
284264	40528	Craig	Troll	9/2/2004	36	SW	152		617
264259	40529	Port Alexander	Troll	9/8/2004	37	NW	113	11	618
284351	40529	Craig	Troll	9/8/2004	37	SW	104	50	652
286175	40529	Craig	Troll	9/10/2004	37	SE	105	10	640
286177	40529	Craig	Troll	9/10/2004	37	SE	105	10	660
286183	40529	Craig	Troll	9/10/2004	37	SE	105	10	672
269723	40529	Craig	Sport	7/8/2004	28	SW	103	70	695
269936	40529	Craig	Sport	7/12/2004	29	SW	104	40	705
269938	40529	Craig	Sport	7/12/2004	29	SW	104	40	780
269942	40529	Craig	Sport	7/13/2004	29	SW	103	80	685
269735	40528	Craig	Sport	7/16/2004	29	SW	104	40	685
269968	40529	Craig	Sport	7/21/2004	30	SW	103	70	620
269966	40529	Craig	Sport	7/21/2004	30	SW	104	40	645
269736	40529	Craig	Sport	7/22/2004	30	SW	103	70	680
269977	40528	Craig	Sport	7/26/2004	31	SW	104	40	685
269748	40529	Craig	Sport	7/30/2004	31	SW	103	70	640
269993	40529	Craig	Sport	8/2/2004	32	SW	104	40	680
269758	40528	Craig	Sport	8/19/2004	34	SW	104	30	750
NON-RANDOM FISHERIES RECOVERIES									
900254	40529	Sitka	Troll	7/13/2004	29	NW	157		
273701	40529	Hoonah	Troll	7/16/2004	29	NW	113	93	650
900789	40529	Sitka	Troll	8/1/2004	32				
901726	40528	Sitka	Troll	9/3/2004	36				
901761	40528	Sitka	Troll	9/10/2004	37	NW	113	45	
NON-RANDOM ESCAPEMENT RECOVERIES									
225981	40528	Chuck Creek	Escapement	9/10/2003	37	SW	103	80	330
225980	40528	Chuck Creek	Escapement	9/28/2003	40	SW	103	80	325
87662	40529	Chuck Creek	Escapement	9/28/2003	40	SW	103	80	310
87664	40529	Chuck Creek	Escapement	9/28/2003	40	SW	103	80	315
87666	40529	Chuck Creek	Escapement	9/29/2003	40	SW	103	80	300
87665	40529	Chuck Creek	Escapement	9/29/2003	40	SW	103	80	310
87667	40529	Chuck Creek	Escapement	9/30/2003	40	SW	103	80	335
87671	40529	Chuck Creek	Escapement	10/1/2003	40	SW	103	80	300
87669	40529	Chuck Creek	Escapement	10/1/2003	40	SW	103	80	315
87670	40529	Chuck Creek	Escapement	10/1/2003	40	SW	103	80	320
87673	40529	Chuck Creek	Escapement	10/2/2003	40	SW	103	80	340
87674	40529	Chuck Creek	Escapement	10/2/2003	40	SW	103	80	345
87675	40529	Chuck Creek	Escapement	10/4/2003	40	SW	103	80	325
87677	40529	Chuck Creek	Escapement	10/6/2003	41	SW	103	80	360

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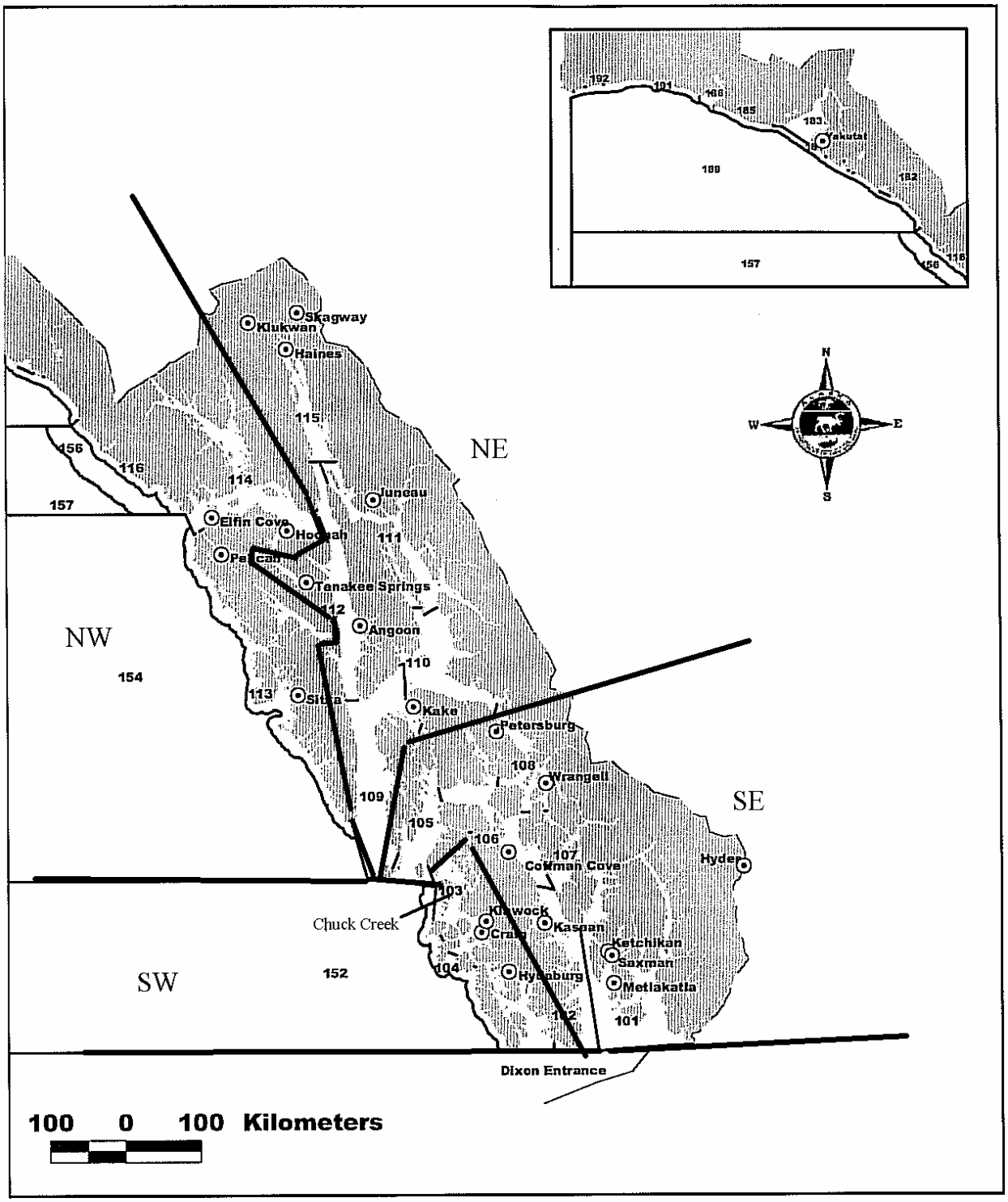
Head Number	Tag Code	Sampling Port	Gear	Recovery Date	Stat Week	Quad	District	Sub-Dist.	Length (mm)
NON-RANDOM ESCAPEMENT RECOVERIES									
87683	40529	Chuck Creek	Escapement	10/10/2003	41	SW	103	80	310
294004	40528	Chuck Creek	Escapement	9/17/2004	38	SW	103	80	605
294006	40529	Chuck Creek	Escapement	9/28/2004	40	SW	103	80	655
294008	40529	Chuck Creek	Escapement	10/6/2004	41	SW	103	80	650
294009	40529	Chuck Creek	Escapement	10/7/2004	41	SW	103	80	580
294011	40528	Chuck Creek	Escapement	11/5/2004	45	SW	103	80	670

Appendix A4.–Map of Southeast Alaska commercial fishing districts and troll quadrants.



Appendix A5.–Computer files used in the analysis of data for this report.

File Name	Description
04Chuck adult weir.xls	Excel workbook containing 2004 Chuck Creek adult escapement data.
03Chuck smolt data.xls	Excel workbook containing 2003 Chuck Creek smolt and coded wire tagging data.
04Chuck Harvest.xls	Excel workbook containing marine harvest estimations and cwt recoveries.